



Hardy Fern Foundation Quarterly



Spring 2013

THE HARDY FERN FOUNDATION

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Web site: www.hardyfernfoundation.org

The Hardy Fern Foundation was founded in 1989 to establish a comprehensive collection of the world's hardy ferns for display, testing, evaluation, public education and introduction to the gardening and horticultural community. Many rare and unusual species, hybrids and varieties are being propagated from spores and tested in selected environments for their different degrees of hardiness and ornamental garden value.

The primary fern display and test garden is located at, and in conjunction with, The Rhododendron Species Botanical Garden at the Weyerhaeuser Corporate Headquarters, in Federal Way, Washington.

Affiliate fern gardens are at the Bainbridge Island Library, Bainbridge Island, Washington; Bellevue Botanical Garden, Bellevue, Washington; Birmingham Botanical Gardens, Birmingham, Alabama; Coastal Maine Botanical Garden, Boothbay, Maine; Dallas Arboretum, Dallas, Texas; Denver Botanic Gardens, Denver, Colorado; Georgia Perimeter College Garden, Decatur, Georgia; Inniswood Metro Gardens, Columbus, Ohio; Lakewold, Tacoma, Washington; Lotusland, Santa Barbara, California; Rotary Gardens, Janesville, Wisconsin; Strybing Arboretum, San Francisco, California; University of California Berkeley Botanical Garden, Berkeley, California; and Whitehall Historic Home and Garden, Louisville, Kentucky.

Hardy Fern Foundation members participate in a spore exchange, receive a quarterly newsletter and have first access to ferns as they are ready for distribution.

Cover design by Willanna Bradner

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President's Message

It's the first week of March and the plants are slowly breaking out of their dormancy. The first crosiers of the Ostrich Fern (*Matteuccia struthiopteris*) are beginning to unfurl. It has been a cool but mild winter with no great dips in the temperature. The Chinese witchhazel (*Hamamelis mollis*) in the yard has been in bloom for almost 2 months as with the *Cyclamen coum* with deep crimson rose blooms that radiate across the patio at the edge of the landscape. The hellebores are in their full glory and tree and shrubs buds are swelling. Spring is 2 weeks away and many of the ferns will then be awaking from their winter's sleep. Unfurling crosiers and expanding fronds are the best of times for viewing ferns. You see the unique, robust growing side that happens quickly once the process begins. I compare it to watching angiosperms blooming. It is a special time to take it all in after the slumbersome winter season.

HFF again was well represented at the Northwest Flower and Garden Show that occurred at the Seattle Convention Center from Feb. 20th to the 24th. Thanks again to Michelle Bundy and Jo Laskowski for putting the education booth together (and down) with the numerous handouts. The 'theme' for this year's booth was the genus *Dryopteris*. It showed the wide diversity that is seen in one fern genus. The Flower Show is the harbinger of spring for the Northwest and it is a great way to launch off the gardening year. A Thank You to all the HFF volunteers who represented HFF and staffed the booth.

This past January at the Graham Visitors Center, at Washington Park Arboretum in Seattle, WA, HFF members and volunteers installed an additional garden bed just north and next to the Fern Display Signature Bed that was installed in early winter of 2004. The design in this bed was to capture a bit of the feel of the Pacific Northwest rain forest. Central elements include a nurse log and three old stumps with some serpentine boulders and of course a good number of ferns and appropriate companion plants. Thanks to the board and volunteers for planting it all out in one afternoon after a morning board meeting. (See the article in this Quarterly).

Next major event for HFF will be the Fern Festival coming up on the first weekend of June on the 7th and 8th. Led by Pat Riehl, HFF board, members and volunteers have come up with ideas to make the Festival a better run event. This is always the premiere event and fund raiser for HFF. It has become one of the largest fern sales in the country offering over a hundred species and varieties. On Friday evening we will be entertained by a lecture and slide show by Sue Milliken and Kelly Dodson, proprietors of Far Reaches Farm in Port Townsend, WA. Sue and Kelly have traveled the world over collecting many unique and rare plants which they add to their ever increasing collection of plants that they offer through their nursery. They have built quite a reputation as plants people and entertaining speakers. We look forward to their program. It is always a pleasure talking ferns with fellow fern enthusiasts, learning about new ferns, new things about ferns and giving out a bit of information.

On May 18th HFF members are invited to Cottage Lake Gardens in Woodinville, WA

for a Trillium tour. Susie and Kevin Egan have created a wonderful garden with the distinction of representing all the species of Trillium that occur in the world. Susie also offered this tour last year to the HFF board and it was a favorite of all who were lucky enough to go. The board was so impressed with Susie and her garden that she was asked to join the HFF board, which we are fortunate, in that she accepted. I won't miss this tour this year. Check the website for current events.

Also check the website for the wonderful collection of fern photographs that is building steadily. May your spring be mild and not too wild. Watch the ferns unfurl.

Happy Gardening. John van den Meerendonk

Adiantum monochlamys

James R. Horrocks ~ Salt Lake City, UT

Originally considered a variety of *A. venustum*, this rather dainty little fern is now known to be a distinct species. The species epithet means "one cloak" or "covering" referring to the single false indusium that protects the usually solitary sorus found midway in the upper pinnule margin. This species, true to the name *adiantum*, sheds water, the leaflets being "unwetttable".... most of the time.

A. monochlamys is native to China, Korea, Japan, and Taiwan where it grows in mountainous areas on stony slopes and in dryish woodlands, often along earthen banks where the fronds can drape downward, giving it a very neat appearance. It is often confused with *A. venustum* but placing the fronds side by side, the differences are quite obvious. The frond outline of *A. monochlamys* is narrowly triangular whereas *A. venustum* has more broadly triangular fronds. The latter also creeps about producing substantial colonies over time while *A. monochlamys* is more compact. In fertile specimens, *A. monochlamys* displays the aforementioned solitary sori on each segment while *A. venustum* displays two. By comparison, the ubiquitous *A. capillus-veneris*, which *A. monochlamys* is sometimes mistaken for, displays two to four sori per pinnule as does the much rarer *A. capillus-junonis*. *A. monochlamys* is considered rather difficult to cultivate while *A. venustum*, once established, is quite easily grown, as is also *A. capillus-veneris*. The latter seems to thrive in soils on the alkaline side. According to David L. Jones, *A. monochlamys* prefers soils a tad more acidic.

Description: The rhizomes are short-creeping and clump-forming, with purplish-brown to dark brown scales that are broadly linear. The stipes are smooth and lustrous, being dark brown to purple-brown in color, and about one-third the length of the frond. The glabrous, somewhat evergreen fronds are narrowly triangular-ovate, four to twelve inches or occasionally even up to sixteen inches long in the wild, but much shorter in cultivation. The fronds are tripinnate to even four times divided, with four to six pinnae on each side. The pinnules are best described as cone-shaped or obtriangular to be technical, and subcoriaceous, meaning somewhat leathery. They have a short dark brown stalk or petiole and are slightly lustrous on the upper side but often somewhat glabrous

beneath. The slender free veins fan out from a dark basal point on the pinnule and run to the tips of the small marginal teeth. The upper margins of fertile pinnules are deeply notched in the middle, usually with a single sorus covered by a reniform false indusium.

Culture: Not so nearly as hardy as other “hardy” maidenhairs, *A. monochlamys* is confidently hardy in zones 8 through 10. In zone 6, it would have to be well protected. Its difficulty of cultivation may be due in part to soil requirements, possibly being more at home in acid soils than alkaline. Found in rocky woods in the wild, it may appreciate the companionship of metamorphic or igneous rocks in the garden. It is particularly attractive where its fronds can hang over an edge. The new spring growth may be somewhat pinkish to salmon-colored, turning a medium green as the season progresses. (see photo page 48) Although considered common in its native haunts, this little fern is a unique and rare addition to any garden once established.

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Welcome New Members!

Steve Casebolt	Candy Jackson	Eric Richardson
James Engan	Sharon Leader	Colleen Rourke
Cynthia Ference-Kelly	Richard Mander	Dale Skrivanich
David Gibson	Amy McCune	Janis Toles
Maren Gilliland	Susan McDonald	Joanne Turner
Iain Jack	Marilyn Michalak	Lia Ward-McClellan
		Roz Horder Williams

Correction ~ New member Sue Dickson’s name was misspelled in last fall’s issue. *Our apologies!*



In Memory of Lyman Black 1923 ~ 2013

It is with much sadness that I inform you of the passing of HFF Board member Lyman Black. Lyman has been a HFF Board member for the past thirteen years and has served as the Foundation's Treasurer since 2002. Lyman had recently handed off the treasurer's reigns to Rick Peterson. Lyman was an excellent treasurer and board member, always with the best in intent and knowledge.

But even more, Lyman was a good friend to all of us on the HFF staff and board. He was kind and empathetic to everyone, always there to lend a hand. He will be greatly missed.

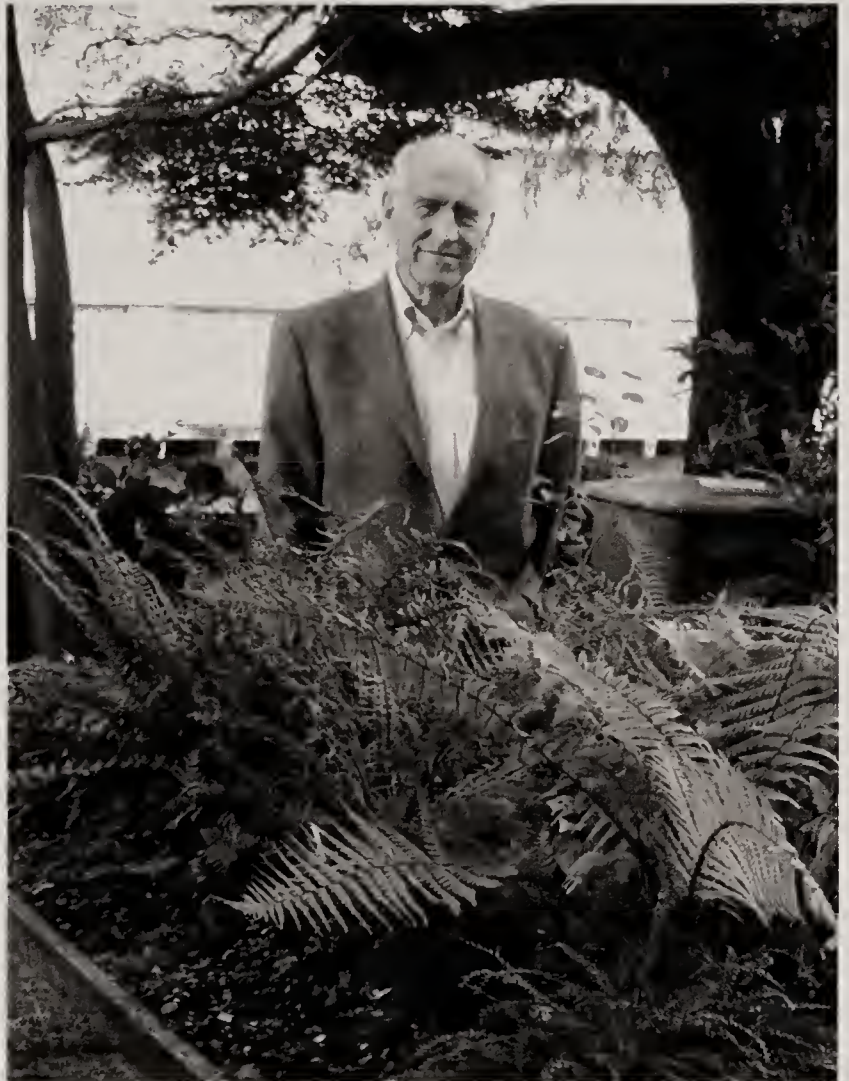
Lyman took excellent care of the HFF Fern Garden at the University of WA Botanic Garden since its installation in 2004, spending a good deal of time to make sure the garden always looked good. Only one month ago we were all together planting ferns in the new addition next to the HFF Fern Garden. Lyman also created some wonderful gardens, mostly with ferns, at the wonderful retirement facility where Lyman and his wife Liz lived when they were in the city. These gardens were a treat for the entire place giving much joy to all.

Many of Lyman's and Liz's weekends were spent at the beach cabin on the

west side of Bainbridge Island with a beautiful view of the Olympic Mountains. The Island is where they lived for many years and where they had raised their family and they always stayed connected to the community and to the happenings on the Island.

Our sincere condolences and sympathies to Lyman's wife Liz, and to their children and family. I will miss our friendship and our wonderful conversations on our shared car trips to and from the monthly HFF Board meetings.

John van den Meerendonk



Lyman with his prized fern table at his home in Seattle.

Photo courtesy of Sue Olsen



Fern Bed Addition at the Graham Visitors Center at the University of Washington Botanical Garden

John van den Meerendonk

Bainbridge Island, WA

This past fall in 2012, staff at the University of Washington Botanical Garden (UWBG) asked the Hardy Fern Foundation (HFF) if they would be interested in landscaping the bed just to the north of the Fern Display Garden in the Signature Bed that HFF installed in 2004. The Signature Bed has been well received and popular and adding a similar addition would improve the landscape and tie the area more together. The HFF Board thought it would be a good idea to add to a display garden that has been so successful and which gives HFF recognition for the work that the Foundation does.

In the first week of this past January, I submitted a rather rough landscape sketch for Fred Hoyt, the Associate Director and David Zuckerman, the Manager of Horticulture & Plant Records at UWGB, to review. The design showed a nurse log and some old stumps and boulders set in a landscape that evoked a bit of the Pacific Northwest temperate rainforest. The space is approximately 12 ft. by 40 ft. and the bed is on north side of the patio that leads to the western entry door of the Visitors Center. The western side of the bed is covered with a nice lacework canopy of branches provided by a very nice existing *Magnolia sieboldii*. Larger plants to be planted were indicated on the landscape sketch but the smaller plants, mostly ferns, were listed in a column on the sketch, with final placement to be determined at time of planting. Both Fred and David received the concept and design well, and gave their approval to go ahead.

On Jan 9th & 10th the bones of the new garden bed were installed by my landscape installation crew at Botanica, Inc. A 20 ft. nurse log 3 ft. in diameter, 3 old cedar stumps, 5 tons of boulders, and 2 chimney basalt basins along with the tools had been collected and loaded up in the trucks the previous day so we could get an early start since we were coming from Bainbridge Island and taking the ferry into town. The City of Seattle provided a medium sized Kubota tractor to move the elements into place which turned out to be the most critical part of the job. The tractor was pushed to the limit to move the large nurse log, stumps and boulders, around beds and under the existing arbor and into place thanks to the skill



HFF members planting ferns.
Photo courtesy of Susie Egan

and fortitude of the wonderful operator. Roger Farrow, who is the Gardener for UWBG was there each day to assist and work with us. The first thing we did when we came onto the job was to lay out the boulders and stumps to determine where each should go and in what order they were going in. We knew where the nurse log was going, which was up front and center. As the job progressed it looked like we might not be able to use the large stump for it was too large to move. It was difficult enough to get the nurse log into place and room was running out in the bed. But it was a beautiful stump and so we tilted it up to get all the soil off and the tractor was just barely able to get it off the truck, over the nurse log and into place. (see photo page 49.) Once the large stump was in place we knew the effort was worthwhile. On the second day of the installation, we finished setting the smaller boulders, and 2 basalt basins in the bed. Four yards of high organic topsoil was spread in the beds. A large boulder placement, along with some plant adjustment, was added to the small bed on the right side of entry door. We were also able to do a bit of needed maintenance on the adjacent Signature Bed. Concrete and galvanized steel post bases were installed to replace the rotted bases of 16 cedar posts holding up the arbor over the Signature Bed. An overgrown rhododendron was removed, a large *Mahonia X 'Charity'* was bought down to scale, a couple of small logs added and organic topsoil added where needed. The new bed was raked out nicely and disturbed paver stones under the arbor were re-set. The stage was now set for planting the new addition.

On the following Saturday, Jan. 12, we had our monthly HFF board meeting at the Graham Visitors Center at UWBG and after a full morning board meeting, HFF members and volunteers went outside and spent the afternoon planting out the new bed. It had been cold all week long with night temperatures in the mid to upper twenties causing a frozen crumbly crust about an inch thick. But it did not hinder the planting. Tall ferns such as *Dryopteris wallichiana*, *Dryopteris goldiana*, and *Dryopteris tokyoensis* were placed toward the back of the bed, and smaller

ferns such as *Asplenium trichomanes*, *Blechnum penna-marina*, *Polypodium glycyrrhiza*, *Polypodium vulgare*, *Polypodium scolieri*, *Selaginella kraussiana 'Aurea'*, and *Dryopteris affinis 'Crispa Gracilis'* were placed in the foreground and at the bases of the stumps, log, and boulders. The area under the drip line of the *Magnolia sieboldii* was planted completely with *Adiantum venustum*.



Finished fern planting.
Photo courtesy of Kris Olsen

Thanks to Jo Laskowski with HFF and Nils Sundquist of Sundquist Nursery for providing the ferns for this project. Thanks to the City of Seattle and the staff at UWBG, for their assistance and good humor, in installing the landscape feature. A big Thank You to the HFF board members and volunteers for planting on a cold day but creating a beautiful landscape. This spring

we will update the plant map and brochure for the Signature Bed and the new addition.

Ed. Note: And a huge thank you to John for the time and effort given to creating and installing such a beautiful garden.

Plantings in the addition to the Signature Bed Display Garden

Ferns

<i>Adiantum venustum</i>	(12 – 2 gal. HFF; 16 – 1 gal. SN)
<i>Asplenium trichomanes</i>	(25 - 5 in. pots) SN
<i>Arachniodes standishii</i>	(3 - 1 gal.) .SN
<i>Athyrium otophorum</i>	(5 - 1 gal.) HFF
“ x ‘Ghost’	(3 - 1 gal.) SN
<i>Blechnum penna-marina</i>	(15 - 5 in.) SN
“ <i>spicant</i>	(3 - 1 gal.) SN
<i>Cyrtomium falcatum</i> ‘Rochfordianum’	(3 - 1 gal.) SN
<i>Dryopteris affinis</i> ‘The King’	(3 - 1 gal.) SN
“ x <i>australis</i>	(3 - 2 gal.) HFF
“ <i>bissetiana</i>	(5 - 1 gal.) HFF
“ <i>brauni</i>	(4 - 1 gal.) SN
“ <i>goldiana</i>	(5 - 1 gal.) HFF
“ <i>affinis</i> ‘Crispa Gracilis’	(8 - 1 gal.) SN
“ <i>koidzumiana</i>	(4 - 5 in.) HFF
“ <i>lepidopoda</i>	(3 - 1 gal.) SN
“ <i>namegatae</i>	(5 - 5 in.) HFF
“ <i>tokyoensis</i>	(3 - 1 gal.) SN
“ <i>wallichiana</i>	(3 - 1 gal.) HFF
<i>Polypodium glycyrrhiza</i>	(8 - 1 gal.) SN
“ <i>scouleri</i>	(8 - 1 gal.) SN
“ <i>vulgare</i>	(8 - 1 gal.) SN
<i>Polystichum aculeatum</i>	(4 - 1 gal.) SN
“ <i>andersonii</i>	(1 - 2 gal) HFF
“ x <i>dycei</i>	(3 - 1 gal.) HFF
“ <i>munitum</i>	(5 - existing)
“ <i>neolobatum</i>	(4 - 1 gal.) SN
“ <i>setiferum</i> ‘Dahlem’	(4 - 1 gal.) SN
“ <i>setiferum</i> ‘Divisilobum’	(4 - 1 gal.) SN
“ <i>setiferum</i> ‘Wollaston’	(4 - 1 gal.) SN
<i>Selaginella kraussiana</i> ‘Aurea’	(8 - 5 in.) SN

Total: 31 different ferns/allies with a total of 188 ferns/allies planted.

Other Plants

<i>Brunnera mac.</i> ‘Looking Glass’	(3 - 1 gal.) SN
<i>Disporum</i> ‘Night Heron’	(1 - 1 gal.) SN
<i>Edgeworthia chrysantha</i>	(1 - 5 gal.) JvdM

<i>Epimedium</i> 'Lemon Zest'	(7 - 1 gal.)	SN
<i>Hellebore</i> 'Golden Sunrise'	(3 - 1 gal.)	SN
<i>Hosta</i> 'Earth Angel'	(3 - 1 gal.)	SN
<i>Hosta</i> 'Praying Hands'	(3 - 1 gal.)	SN
<i>Primula</i> 'Kathryn Alice'	(3 - 5 in.)	SN
<i>Rhododendron</i> 'PGM Compacta'	(1 - 2 gal.)	JvdM
<i>Rhododendron cilpinense</i>	(1 - 2 gal.)	JvdM
<i>Sarcococca humilis</i>	(2 - 2 gal.)	JvdM
<i>Vaccinium ovatum</i>	(2 - 3 gl.)	JvdM

Total: 30 other plants planted

HFF - Hardy Fern Foundation

SN - Sundquist Nursery

JvdM - John van denMeerendonk

A Frond By Any Other Name ...

Joan Eiger Gottlieb

Pittsburgh PA

PART I

FIRST FRONDS

Every spring in the temperate zone we watch them swell, assume their fiddlehead pose, and finally unfurl into the fronds we know and love. These are the leaves of our favorite ferns and their formation is surprisingly similar whether they belong to a towering tree fern (*Cyathea*) or a tiny mosquito fern (*Azolla*). From the time vascular plants appeared in Silurian era swamps ~400 million years ago, their primitive stems scarcely more than green stalks with generative growing tips (meristems), an adaptational race was on to increase the surface area for photosynthesis and reproduction. The winners of this race would have the energy reserves to outgrow and out-reproduce other members of their cohort, colonizing the earth and cloaking it with progressively larger, more complex, dominating leaves.

Different evolutionary lines within the early land plants accumulated mutations over time that enabled the production of various types of surface enhancements on their primitive shoots. Among the club "mosses" (*Lycopodium*), spike "mosses" (*Selaginella*), and quillworts (*Isoetes*), dermal cells at the base of the shoot's apical meristem (permanent growth zone) developed into Lilliputian microphylls - simple,

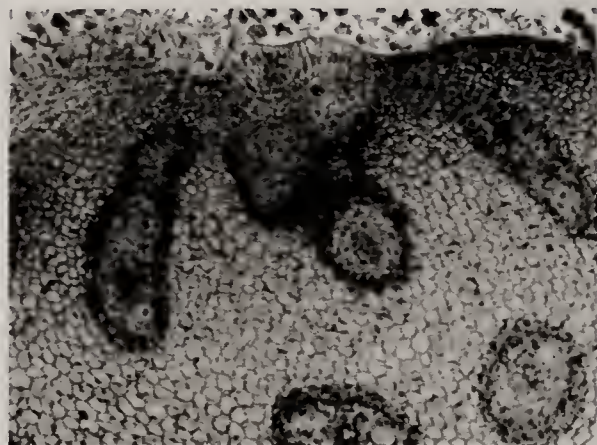


flat outgrowths with a skinny strand of conducting tissue connected to the edges of a central vascular cylinder (protostele) in the stem, forming a basic, continuous, transport system for water, minerals, and organic molecules. Microphylls have no apical or marginal meristems, and undergo a brief period of plate-like proliferation until all cells mature.

All other vascular plants – horsetails (*Equisetum*), ferns (*Psilotum*, *Ophioglossum*, *Marattia*, *Dryopteris*, etc.), and seed plants (*Cycas*, *Pinus*, *Lilium*, *Magnolia*, etc.) have (or once had) “true” leaves (megaphylls). A megaphyll, regardless of size or architectural complexity, is a reduced branch system that has been flattened and “webbed” by differential growth and lateral division. A fern megaphyll or frond arises close to the center of the shoot apical meristem as a single-celled primordium that proliferates into a small mound. A leaf apical cell is quickly established along with marginal meristems that generate blade (lamina) tissue. As the primordium develops and protrudes outward, its elaborate conducting system of veins exerts a huge impact on that of the shoot from which it arises. It might even be accurate to describe the primary vascular system of a typical fern stem as a collection of foliar veins (xylem and phloem bundles - a dictyostele), interconnected below and above each leaf trace. The megaphyll truly represents the ascendancy of the leaf as the dominant force shaping higher plant structure – a far cry from the microphylls that evolved in other early plant lineages.

MERISTEM MATTERS

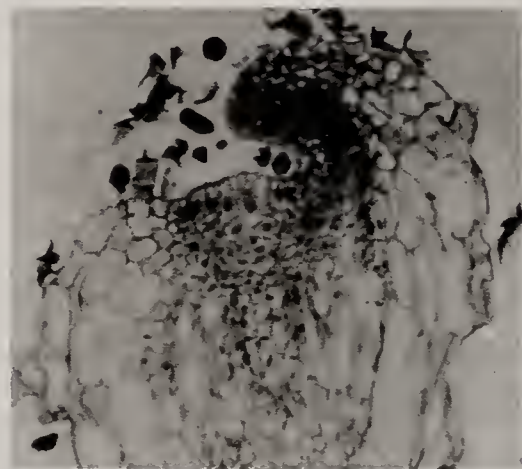
The shoot apical meristem of a typical fern is a shallow dome with one permanently generative cell at its tip. Actually, the apical cell seldom divides and can undergo long periods of dormancy. However, the occasional daughter cells it produces are hot beds of mitosis (equal nuclear division preceded by DNA and chromosome doubling and usually followed by division of the cell), creating an array of cell types that differentiate into all the adult tissues and organs of the plant body for as long as the plant is alive. Think of retaining one or several cells from your embryo in reserve at the tip(s) of your body. These cells would remain permanently embryonic with the potential to generate new body parts as needed throughout life in a controlled (non-tumorous) way. The genius of plants is that their sporophytes do exactly that, reserving totipotent cells from their embryonic stage as meristems. As each leaf, branch, or root takes shape, one or more cells of those organs may also be set aside as later-use meristems (think axillary buds or bulblets). At a later time, and under specific hormonal and/or environmental influences, these saved,



Origin Short Shoot

Lengthwise/oblique section of a mature *Pteridium* long shoot apex (rt.) and the origin of a short shoot apical meristem (lft.) Note vascular bundles forming below meristem.

Photo courtesy of Joan Eiger Gottlieb



Five Leaf Stage Meristem

Lengthwise section through the meristem of a 5-leaf sporophyte of *Pteridium* showing the apical cell and a new leaf forming.

Photo courtesy of Joan Eiger Gottlieb

undifferentiated cell nests can be reactivated to create new structures, or even grow into whole new plantlets – an effective way to propagate clones of one successful parent. Within the meristematic dome, the cells that become branch or leaf primordia are labeled P1, P2, P3, *etc.* where P1 is the youngest or most recently generated. The primordia are formed in a pattern such that each is spaced as far from the older primordia and from the shoot apical cell as possible. This “phyllotactic” arrangement can be seen as a tight spiral in the winter crown of most upright ferns and resembles the pattern seen in a sunflower “head” or the seed cone of a pine tree. By the time a primordium is in the P2 stage of development its fate as either a leaf or a branch is established. In a series of elegant experiments on *Osmunda* meristems, Wardlaw *et al.*¹ made minute incisions between the shoot apical meristem and its primordia. When P1 was separated physically from the meristem, but remained in physiological (hormonal) contact, P1 always developed as a leaf. When a non-permeable barrier was inserted between the two, about one third of P1 primordia developed as new shoots. The fate of a new primordium is influenced by both the apical meristem and by older primordia in a growth repression/stimulus balance achieved through growth hormone (auxin) concentration levels and directional flow. Relatively high auxin levels flowing from rapidly growing leaves and from the apical meristem keep axillary buds dormant until leaves mature and the apical meristem of the main shoot is far enough above the bud to dilute its repressive hormonal effect. The key point is that all actively growing plant parts produce growth hormones that travel downward, promoting or preventing cell elongation by altering the permeability of cell membranes to water.

There are usually more primordia formed than leaves that emerge in a growing season. The surplus primordia are a reservoir that can be activated quickly if older leaves die in a drought or are removed. Everyone who gardens has experienced this rapid renewal effect. Steeves *et al.*² showed that a mature *Osmunda* bud contains four annual sets of reserved primordia. They form a flexible system that helps ferns adjust quickly to changing conditions. Growth is very slow in the youngest sets, but in the fourth year apical activity speeds up in the oldest (outermost) sets and a crosier takes shape. These will be the fronds that mature and unfurl in the fifth year of their long, slow development.



First Five Leaves

First five leaves of a *Pteridium* sporeling showing succession from bipinnate to more complex.

Photo courtesy of Joan Eiger Gottlieb

The powerful influence of the fern frond is also apparent in species with horizontal shoots (rhizomes) that grow at or below the soil surface. In rhizomatous ferns like bracken (*Pteridium*) two types of branches are formed – rapidly elongating, spreading long-shoots, and stubbier, slower growing short-shoots, the latter bearing most of the leaves. This pattern helps the fern colonize a large area while also forming large fronds that provide the photosynthetic energy for its invasive growth. The writer worked on bracken development³ and verified that its branching pattern is influenced by growth hormones. Auxin stimulation of cell elongation creates long-shoots, but, the higher

hormone concentration produced by its robust, developing fronds inhibits the elongation of short-shoots. The young sporophyte (sporeling) of bracken fern (*Pteridium*) emerges from its parent gametophyte in a typical, upright growth form. The shoot resembles a tiny vase. It produces about eight juvenile leaves, each progressively larger and more pinnate. Then, as if on cue, the shoot apical cell divides into two equal parts, looking like the top of a heart, and two downward growing branches begin the long-shoot, short-shoot rhizome system described for the adult bracken - a remarkable transition!

FROM PRIMORDIUM TO FROND

Once a primordium has formed and is set on a foliar pathway its form is genetically controlled by specific structural proteins. In ferns, plus a few seed plants, *e.g.*, *Cycas*, *Drosera*, subsequent development of the frond usually produces a coiled fiddlehead (crosier). Through differential growth (more on one side than another) each leaf primordium elongates, flattens, and bends over on itself, creating a protective coil within which lateral cell division generates the laminar (blade) tissue. The leaf primordium, in a temporary growth spurt, thus establishes the frond architecture of its species, down to the degree of dissection (pinnae, pinnules, lobes), venation, sporangial initials, texture, *etc.* The entire frond is complete within this “circinate vernation.” In cold climates there is typically a seasonal dormancy in which the compact ball of crosiers remains protected as a winter bud, some crosiers emerging and uncoiling later as the signature fiddleheads of spring - everything from white-bearded crosiers of *Osmundastrum cinnamomeum* to glistening, black, fuzzy types of *Dryopteris wallichiana*. It is a cascade of differential cell elongation mediated by the uptake of abundant spring rains, moderating temperatures, and, yes, the renewed flow of growth hormones.

Eventually the growth frenzy slows as the frond completes its unfurling. Most of the cells (including apical and marginal leaf meristem cells) have elongated and matured, strengthening their cell walls with additional cellulose. Lignin has been added to the walls of water-conducting tracheid cells and supporting fibers in the veins. Storage and photosynthetic tissues have formed in the mesophyll. Farinas, waxes, scales, hairs, and glands may decorate and insulate the epidermis, leaving small pores (stomata) for gas exchange. At this point, additional size and shape change ceases and the frond is said to be “determined.” A few ferns, *e.g.*, climbers like *Lygodium palmatum*, exhibit ongoing foliar growth. They retain their leaf apical meristems, and continue to produce increasing lengths of rachis and sets of pinnae until reproductive pinnae appear at the growing tip, finally ending the growth spree. The walking fern (*Asplenium rhizophyllum*) also retains its frond apical meristems, enabling the simple, heart-shaped leaves to continue adding length until the arching tips touch ground. There they quickly establish the roots and shoots of tiny plantlets. In this way the species “walks” over limestone outcrops, spreading its charming clones.

Let us not forget the “indeterminate” potential of dormant buds and bulblets that routinely form on various parts of the leaf in quite a few fern species. These scattered, proliferous meristematic nests can be seen along the otherwise mature rachises of *Cystopteris bulbifera*, *Diplazium macrophyllum*, and *Polystichum setiferum* ‘*Divisilobum*’. Depending on the species, they may generate plantlets while still attached to the parent leaf (especially as

the frond ages and lies prostrate on the soil) or they may fall off to roll away from the parent and grow into new plantlets where conditions are favorable. On other species, meristematic nests are at the ends of veins on the lamina, e.g., *Asplenium bulbiferum*, *Ceratopteris thalictroides*. The latter is an aquatic fern with deeply lobed fronds that bear small, undifferentiated buds in the lobe sinuses. When the frond approaches maturity, these “reserved” buds resume development, producing roots, stems, and leaves of their own. On contact with water, they separate from the parent frond as it senesces or is jostled. In tropical waters these rapidly proliferating plants have been known to choke waterways.

A series of experiments by the writer⁴ showed that these *Ceratopteris* leaf notch buds, if excised when young and placed on a complete nutrient medium in a tissue culture, usually died or produced aposporous gametophytes directly from sporophyte leaf tissue (by-passing spores!). However, when as little as one mature leaf vein was left attached, or when a small amount of adenine (a known leaf-promoter) or indole-acetic-acid (a plant growth hormone) was added to the medium, plantlets quickly emerged. Once again it should be apparent that physiological concentrations of growth regulators within maturing leaves are repressive or stimulatory as frond development progresses and the plant body takes form. Imaichi’s chapter on “Meristem organization...” in Ranker and Haufler⁵ is an excellent, well-illustrated review.

(to be continued)

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Ferns and Allies on the Annapurna Base-Camp Trek, C. Nepal

Chris Fraser-Jenkins

Kathmandu, Nepal

Namaste from Nepal. I was lucky enough to get away from the city last week as I'd long been wanting to make a little trek up to the Annapurna Himal to look again at a very interesting new *Polystichum* I found the last time I went up there in December 2006. I had named it *Polystichum centronepalense* Fraser-Jenk. & Tamang, *Taxonomic Revision of Three Hundred Indian Subcontinental Pteridophytes with a Revised Census-List*: 417 (2008). But the type has rather small and old fronds and I wanted to see more of it as it is an attractive species with densely pale-scaly rachis and costae and a few slightly darker scales often present at the stipe-base. It is intermediate between *P. sinense* (syn.: *P. wilsonii*) and *P. piceopaleaceum*. (see photos page 48.)

I also wanted to make a first Himalayan trek with my small son, Jacob, as it is possible we may be going to England, back to the Natural History Museum, London, and Edinburgh Botanic Garden later this year, and might not visit the Himalaya again. So on May 29th, my sister-in-law, Sagun Pariyar, Jacob and myself headed off by public microvan to Pokhara, and the next morning up to the north towards the towering snow-peaks of the Annapurna range, starting our 8-day walk at Naya Pul. The path follows the rushing Modi Khola River going up northwards from 1000 metres altitude to 4100 m. where it ends in a magnificent snowy cirque between Annapurna I (8090 metres), Hiunchuli, Annapurna III and Annapurna South (7220 m.). On the way one passes the incredibly sheer, craggy Matterhorn-like twin peak of Machapuchare, the Fish-tail mountain (at 6990 m.). It is very fine walking country, well provided with comfortable lodges at convenient distances along the way or at the Base Camp, and is of course incredibly fine fern-country - especially as the Pokhara area has an exceptionally heavy rainfall due to its lakes and the fact that Annapurna lies nearer to the plains, south of the line of main-ranges in other parts of Nepal, so catches much more rain. But this being shortly before the monsoon reaches here from the East allowed us some very fine views of the towering masses of gleaming, fresh-snowy peaks. At one very fine view as we came round a corner, I kidded Jacob that a large space-ship full of vanilla ice-cream had crashed there years ago and



Modi Khola River

Photo courtesy of Chris Fraser-Jenkins

Annapurna was actually a gigantic secret ice-cream supply - the real reason everyone likes to trek up there! Although we met other trekkers every now and again *en route* and

in the lodges it was not at all crowded due to the recent strikes and political uncertainty in Kathmandu, thankfully over for now, but which reduced the numbers of visitors to Nepal.

Up to about half-way, at Sinuwa (2350 m.) is the buffer zone of Annapurna National Park, with small villages and fields on the slopes and patches of forest, but beyond that, real dense forest begins and leads on until one gets above the tree-line at Deurali (3200 m.). Nevertheless there are many interesting ferns in the lower zones as well, and I recorded over 120 species of pteridophytes there, including eight common *Selaginellas*, nine well known Polypodiaceous epiphytes, (see photo page 49.), seven silver-ferns (*Aleuritopteris*) nicely layered in their respective altitude-zones, including the wrinkly little *A. formosana*, hairy *A. dubia* and rather to my surprise, *A. subdimorpha*, usually more eastern in range, though known previously from above Kathmandu. I also spotted 16 species of *Pteris*, 15 *Thelypteris*, 11 athyrioids and half-a-dozen *Dryopteris* and *Polystichum* each - but the real “goodies” were further up in the rich flora of the main reserve, with a further 120 species. Just above New Bridge (1500 m.) on the steep dripping north bank of a deep stream valley I looked at a population of a rather strange large *Tectaria* I found in 2006 and initially reported tentatively as possible *T. dubia*, a species described by the late Professor Ching from Lakhimpur in Assam. I then felt it must just be a more glabrous *T. coadunata* with fewer free veinlet tips in the areoles of its net-veining, but seeing it again I really don't know what it is - so whether or not it is *dubia*, it is certainly dubious! But *T. dubia* is so very little known, only the type is at Kew, and no more collections anywhere outside China, so it is hard to say.

After New Bridge, a leg-jellifying steep step-climb of 500 metres goes straight up the side of the valley past Jhinu lodge, with its curious hot-spring (and pink toads, as Jacob discovered at night with a torch, while moth-spotting), up to the attractive main village of Chomrong, where welcome cold drinks with a front of a fine Himalayan view refreshed us before going down again to cross a side-stream coming down from Annapurna South. It was nice to find little *Asplenium laciniatum* subsp. *kukkonenii* growing in the stone walls at the top of the village, and among them also *A. khullarii*, with a slightly stiffer, darker frond and more pointed segments. Leaving Chomrong dale behind, one then climbs up to Sinuwa lodge (2350 m.), where, on day three of our trek, the core conservation area of the Park begins and with it the most superb mossy, dense mixed-forest imaginable. (see photo page 49.) Who says ferns are no longer the dominant vegetation? - here they certainly are, as the path between the silent old twisted trees is lined with spectacular shuttlecocks of the big Dryopteridaceous ferns - the Polysticho-Dryopteridetum zone. Huge baskets of *Dryopteris wallichiana* of all three subspecies, subsp. *himalaica*, subsp. *nepalense* and subsp. *wallichiana* - each more splendidly shaggy than the last - are interspersed with great glowing green shuttlecocks of *Polystichum longipaleatum*, with young fronds like bunches of hairy caterpillars and the glossy mature fronds provided with long stiff hairs all over the pinnules. But also for the avid *Polystichum* specialist, the more subtle delights of black-scaled *P. piceopaleaceum*, and the very fibrillose and lobed *P. yunnanense*, wider fronded *P. mucronifolium* (syn.: *P. heteropaleaceum*, *P. tacticopterum*), with broad scales all up the rachis beneath, simple-pinna'd *P. nepalense* and its bipinnate relative *P. manmeiense*, both with tiny microscales all over the lower surfaces, also a few *P. annapurnicola*, with narrower scales, very

continued on page 50....



*Polystichum
centropaleaceum*

Photo left courtesy of
Chris Fraser-Jenkins

Polystichum sinense

Photo right courtesy of
Chris Fraser-Jenkins



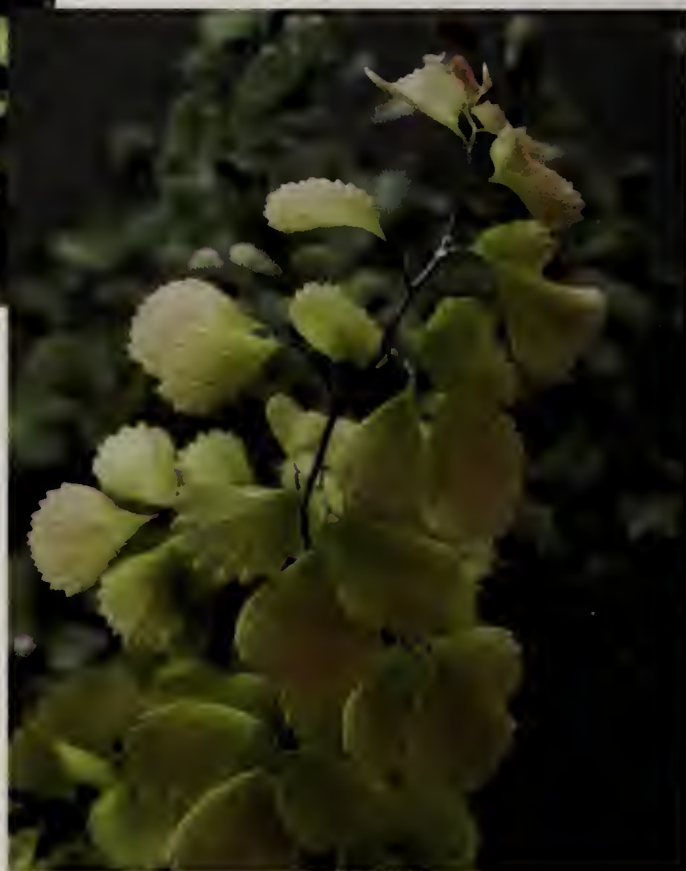
*Polystichum
piceopaleaceum*

Dense forest above Dovan

Photo left courtesy of
Chris Fraser-Jenkins

*Adiantum
monochlamys*

Photo right courtesy of
Sue Olsen





**Low-mid level
epiphytes in full
glory**

Photo left courtesy of
Chris Fraser-Jenkins

Northwest Flower and Garden Show

Photo right courtesy of
Jo Laskowski



Fern bed construction at the Washington Park Arboretum

Photo left courtesy of
Randall Hitchin

Fern Garden Nepal

Photo right courtesy of
Chris Fraser-Jenkins



finely lobed pinnules and wide, flat indusia. The latter is a species more common on the south side of Machupuchare, which I unexpectedly discovered some 20 years ago when living in Pokhara. Further along, sticking out from the ferny path-side were the glossy stiff fronds of the very fine species, *P. neolobatum* (syn.: *P. garhwalicum*), with dense, broad, pinkish-yellow scales all up the stipe and rachis, and on rock surfaces and crevices, there were two delightful little species, *P. thomsonii*, like an elongated *Asplenium laciniatum*, and very variable in depth and crowding of lobes, and the fascinating miniature, glossy-leaved *P. stimulans*, so named because its sharp teeth can prick one like Holly - very stimulating if handled unsuspectingly! The trees themselves were festooned with epiphytes and the branches covered with dense masses of the filmy ferns, *Hymenophyllum exsertum* (with long hairs scattered beneath), *H. tenellum* (“*H. polyanthos*” of Asia), *Trichomanes latealatum* and occasional *T. campanulatum* (with short-hairy stipes etc.) and masses of hanging grass-like *Vittaria taeniophylla* (syn.: *V. himalayensis*) with superficial inframarginal sori with no inner ridge to them as occurs in *V. flexuosa*, both so unnecessarily placed in a pseudogenus “*Haplopteris*” by N. American molculologists of less than sensible taxonomic ability and a near religious misbelief that clades are taxa that must be recognised and named. Also covering the branches were *Loxogramma involuta*, *L. cuspidata* (with a creeping rhizome), hanging *Goniophlebium argutum*, masses of huge *Polypodiodes amoena*, among superbly flowering pink and white orchids, *Dendrobium* etc. Another rarity here is *Vittaria linearifolia*, with smaller, narrower fronds than the other *Vittarias* and yellow sori filling the space between the midrib and margin. On the darker mossy rocks, or on old moss-covered tree-trunks, tiny, dark-green *Asplenium capillipes* is pressed under small overhangs, and the two very characteristic little Grammitids occur, *Tomophyllum donianum* (widely mistakenly known in India as the Malesian *Ctenopteris subfalcata*) in 3 inch clumps on tree trunks and the delightful *Micropolypodium sikkimense* (formerly misplaced in *Xiphopteris*, which Dr. Barbara Parris has found to be a quite different genus). *M. sikkimense* has much narrower and longer fronds than *Tomophyllum*, with many longish, stiff, black hairs at the edges of its tiny lobes, and hangs off large boulders.

Fortunately from Sinuwa onwards there is less of the back-breaking abrupt climbing apart from a few ups and downs to cross streams or avoid cliffs, and the spectacular views of Machapuchare across the valley to our right or of the great snow-peak summits looming sky-high ahead of us became more enjoyable with less exhaustion, and so did the ferns as the path gradually led us up to higher altitudes at the tops of the forest. It was also good that the mornings were very bright and fresh, but clouds built up by midday to shield us from the hot sun and only by late afternoon did thundery rain begin - just in time for us to reach the next lodge. Day 4 saw us staying at 3200 metres at Deurali Lodge, passing Hinko cave, where the Buddhist sage and flying magician, Milarepa, meditated his way through the Himalaya several thousand years ago, presumably enjoying the views as much as we did today.

Deurali is at the top of the forest, where the open Himalayan scrub and rocky grassland begins and the whole area becomes a high-Himalayan fern paradise. In the rocks there and at the upper forest level I at last found the main populations of the elusive *Polystichum centronepalense* - and what a distinctive and lovely species it is! The wide, pale scales are a bit like those of the beautiful Japanese species, *P. ovatopaleaceum*, but have remarkably laciniate-fimbriate edges, I have the impression that its intermediacy

between *P. sinense* and *P. piceopaleaceum* suggests that it might be an allopolyploid, neo-endemic species, derived from the other two (similar to *Dryopteris filix-mas* of Europe and Kashmir being derived from *D. oreades* and *D. caucasica*). My great hope is that now at last we have a new fern-cytologist in our midst again - Dr. Alka Kumari of the IHBT, Palampur, and I hope she might be able to do a chromosome-count of both it and the other proposed neoendemic, *P. annapurnicola*. Growing here and there amongst it were probable *Dryopteris costalisora*, wonderful plants of *Matteuccia intermedia* (another to me unacceptable and unnecessary pseudogenus of molecular cladonomy, “*Paltonia*”) showing the tapering frond-base and last year’s fertile fronds with thick cylindrical fertile pinnae, masses of *Thelypteris mollissima* (Section *Stegnogramma*), with fusing pinnae at the apex and creeping rhizomes, occasional stands of *T. squamaestipes* in wet places, red-axis’ed *Athyrium atkinsonii* with deltate fronds and cystopteroid indusia that completely destroy the imagined distinction of the new molecular pseudofamily, “Cystopteridaceae” (!), occasional hairy-stiped *Nothoperanema squamiseta*, and masses of delicate *Cystopteris moupinensis* on the semi-open forest floor. A delightful place, which reduced my speed of walking nearly to going backwards! In the meantime our Jacob was racing backward and forward with all the energy of a seven year old, looking at butterflies, the several different ladybird beetles, and seeking the elusive “rainbow bird”, which both he and I reckon we saw - brightly coloured birds flying among the rhododendron and white-flowering *Cornus* bushes in the sun. The butterflies too were nice, Jezebels, Clouded Yellows, Indian Orange-tips, Himalayan Red-Admirals, various swallowtails and Pansys, stripey gliders flitting over the flowers and the lovely map butterfly that sits with its delicately indented wings open flat on the ground like an old 18th century map.



Chris Fraser-Jenkins

Photo courtesy of Chris Fraser-Jenkins

Above Deurali we were up in the Himalayan meadows, masses of blue and pink *Primulas*, a superb clump of the Yellow Lady’s Slipper orchids, white *Habenarias* and carmine-red *Dactylorhizas*, tiny violets and blue pea-flowers, wild strawberries that soon became Jacob’s mainstay, pink *Roscoeas* and super-hairy clumps of blue or white Himalayan *Meconopsis* poppies, also the curious black leaves of the aroid, “*Lali?*”, *Arisaema*, eaten as a vegetable, and whose pointed sword-sheaths were emerging from the ground as if a menacing denizen from some lower kingdom beneath the surface, especially by the old snow-patches. Shaggy brown vernating fronds of *Dryopteris barbigera*, were also doing the same trick in patches where the old leaves had died away. The ferns up there were superb, sweet-smelling, scaly *Dryopteris komarovii* on the rocks, wonderful white-scaly masses of *Polystichum sinense*, all densely covered in white hairs and scales and fertile at any stage from 3 inches to nearly 3 feet, delightful little clumps of fresh green *P. lachenense*, taller *P. prescottianum* and *P. shensiense*, *Cystopteris fragilis* subsp. *dickieana*, and what I hope is the tiny high-Himalayan unnamed subspecies of *C. fragilis*, with very small-sized, spiny spores, I first noticed from Gorkha, and then

above Muktinath temple (north of the Annapurna range in Mustang - the “Tibetan” side of the Nepalese Himalaya) - might it be one of the elusive “missing diploids” of the genus? Another most lovely fern there was the rare European element, *Cystopteris montana*, with delicate and finely dissect deltate-pentagonal fronds, growing at the bases of mossy boulders - which was not known so far east before. Also adjacent to it was *Gymnocarpium jessoense*, an “Oak fern” but not the same as the common W. Himalayan *G. fedtschenkoanum*, which has more rectangular segments - this one occurs further east in China etc., but I discovered it anew to the Indian subcontinent in Bhutan and Mustang a few years ago. Others in evidence here and there between the boulders were *Adiantum pedatum* (true *pedatum*, not *A. myriosorum*) and *A. wattii* (syn.: *A. refractum*), the latter like a high-altitude toothless *A. capillus-veneris*-like species. Two very interesting little *Woodsias* were also there in rock-crevices, the very hairy *W. andersonii* and another, slightly less densely hairy one with a pale rachis and square-lobed pinnae, perhaps *W. rosthorniana*, not sure yet. Over to the north at Muktinath, I was delighted to find two rare, less hairy *Woodsia* species, *W. hancockii* and the very rare, narrow-fronded *W. glabella*, the latter not previously known in the Indo-Himalaya until I stumbled upon it.

After climbing across a slippery ice-slope plunging down to the turbulent river below we reached Muktinath Base Camp lodge (3700 m.) on day 5, and Jacob and I took a little walk around above it in the rocks beneath the incredibly steep snowy crags, where I found lots of tiny *Cryptogramma stelleri* and beautiful spotted-green fritillary flowers - we could see up into the cirque near our final target, Annapurna Base Camp, before cold clouds rushed in as fast as a train, scattering the Alpine Choughs with a thunder-crash and started pelting us with hail-stones. But then trouble unexpectedly struck us, while Jacob and I were fine, Sagun suddenly developed a severe headache and vomiting, and could neither make sense talking, nor breathe deeply - almost not at all. She had been struck by acute altitude sickness! So at 5.00 in the afternoon we had no choice but to grab our rucksacks and race down back towards Deurali in the hail. Luckily both the hail and her difficult breathing eased off after going down about 300 metres, but the light was fading when we reached the big snow and ice slide, which we had to cross to get to the lodge, shortly on the other side. No path was cut across it by the committee controlling the lodges etc. (why on earth NOT, one should ask!?), but now, unlike when it was frozen solid that morning, it was slightly melted and slippery as hell - with the steep slope plunging down to what would be instant destruction in the tumultuous smashing waves and rocks of the ice-cold torrent below. To make it worse, the recent hail was like slippery ball-bearings all over the surface, but we had no choice but to go on, and no information had warned us one might need crampons for the treacherous crossing, or even that it existed. Our local Brahman porter, Sunil, rose magnificently to the challenge and managed to get Jacob across, but Sagun couldn't make it with me and both of us had to sit on the ice-slope (having removed our slippery anoraks in case of sliding) until she slid her way back to the edge. I then slid my way across on frozen behind and thighs, but after crossing the first ridge of ice was most alarmed not to see any sign of Jacob and the porter, only the empty slope going down to the river. But on the second ridge what a relief to see the porter coming back out of the gloom and little Jacob calling “Daddy!” from among the safety of the boulders on the other side. I dug my frozen fingers into tiny crevices and tried to hang on, but even so suddenly took a slide and only just managed to come to a stop above a safe rock - and then got across and went to meet Jacob, now pretty

upset, but relieved, poor little lad. After what seemed an age in the freezing cold and increasing dark, Sunil at last appeared over the ridge pushing and hanging onto Sagun, with many a slip, until they made it. Thank goodness we were all safe, thanks to the magnificent efforts and courage of Sunil. But it is not a safe place at all due to their not cutting any path, and I have to wonder what the Committee and ACAP, the Annapurna Park authorities, think they are doing leaving things like that for hundreds of people to risk, if, like us in emergency, one has to cross it later in the day. From there on it was by torch-light just down the steps back to the comfort of Deurali Lodge, where we warmed up changed our muddy clothes and recovered from the ordeal, thanking the Gods of all our religions (Jacob has a secret traditional Hindu name, but has also been granted a Tibetan Buddhist name by the Abbot of Karma Samtenling Monastery, and inducted into Buddha Dharma as Tashi Palden). Also thanks to chow-mien, a plate of chips and a hot chocolate with a nip of Roxshi spirit in it (at pretty steep prices up there!) and a comfy warm bed we shared.

Next morning in the fresh bright sunshine we began our 3-day return from the gleaming snow-peaks and enjoyed the trek back through the beautiful countryside - but could hardly be blamed for cheating a bit at Siwai (below New Bridge) and taking the Jeep back on the new road they have made down to Naya Pul. We got off a bit before Birethanti as there is a population of *Pteris vittata* on the road-side banks there, with many short, narrow pinnae, a short apical segment and erect fronds - exactly as one would expect for the diploid subsp. *vermae*. Again this is a prime candidate for chromosome-counting, as subsp. *vermae*, though seeming to occur commonly in Pithoragarh, Nepal, Bhutan and Arunachal Pradesh (in addition to China) has never yet been counted to confirm it from India, apart from Prof. Verma's original count on the type material from below Nainital. After seeing the *Pteris* and taking refreshingly chilled local fruit lassee in a hut by the track, we leapt into a taxi at Naya Pul in an absolutely blindingly heavy rain-storm that followed us over the pass to Pokhara, whose streets were by then awash and nearly knee-deep in charging waters - but this was not the imminent monsoon we so await, that still hasn't broken as I write, but just the very heavy and famous Pokhara rainfall.

All in all it was a great trip that luckily ended well despite the unexpected difficulty and danger we had - but one day I wouldn't mind just seeing what else might grow that 400 metres and a few km. higher up, at A.B.C. (Annapurna Base Camp), itself!

Chris Fraser-Jenkins, Naya Bazaar, Kathmandu - 15 June 2012.

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Here below is a list of the ferns seen:

244 Pteridophytes seen during trek from Naya Pul to Machapuchare Base Camp, N. of Pokhara, Kaski District, C. Nepal, 27.5-1.6.2012

C.R. Fraser-Jenkins, with Jacob C.B. Fraser-Jenkins, Sagun Pariyar, and porter (Sunil). (Total number of species and subspecies known from Nepal: 554).

1. Naya Pul (700 m.) to Birethanthi - Syauli Bazar - Siwai - New Bridge - Jhinu - Chomrong - Lower Sinuwa (Buffer Zone).

Huperzia hamiltonii f. *petiolata* (seen in 2006).

Huperzia squarrosa.
Lycopodiella cernua.
Selaginella bisulcata.
Selaginella chrysorrhizos, mainly old, dead fronds.
Selaginella involvens.
Selaginella monospora.
Selaginella pallida.
Selaginella pennata (seen in 2006).
Selaginella subdiaphana.
Selaginella vaginata.
Equisetum diffusum.
Equisetum ramosissimum.
Lygodium flexuosum.
Lygodium japonicum.
Dicranopteris lanigera.
Dicranopteris taiwanensis (seen in 2006).
Drynaria propinqua.
Lepisorus contortus.
Microsorium membranaceum.
Phymatosorus cuspidatus subsp. *cuspidatus*.
Polypodiodes lachnopus.
Polypodiodes microrhizoma.
Pyrrosia costata.
Pyrrosia flocculosa.
Pyrrosia porosa.
Dennstaedtia scabra (seen in 2006).
Hypolepis polypodioides.
Microlepidia firma.
Microlepidia platyphylla.
Microlepidia setosa.
Microlepidia speluncae.
Pteridium revolutum.
Odontosoria chinensis subsp. *chinensis*.
Adiantum capillus-veneris.
Adiantum incisum subsp. *incisum*.
Adiantum philippense subsp. *philippense*.
Adiantum philippense subsp. *teestae* (rare, Birethanti, seen in 2006).
Aleuritopteris anceps (seen in 2006).
Aleuritopteris bicolor.
Aleuritopteris dealbata - New Bridge.
Aleuritopteris dubia.
Aleuritopteris formosana.
Aleuritopteris rufa.
Aleuritopteris subdimorpha - very restricted, New Bridge to Shyauli Bazaar.
Cheilanthes tenuifolia.
Onychium japonicum subsp. *japonicum*.

Onychium siliculosum.
Onychium ?*fragile* - a small, lower altitude plant similar to *O. cryptogrammoides* but less thin-herbaceous, which occurs also at Tatopani, Kavrepalanchok District and elsewhere. Chomrong to Jhinu.
Pityrogramma calomelanos.
Pteris arisanensis.
Pteris biaurita subsp. *fornicata* (rare, Birethanti, seen in 2006).
Pteris biaurita subsp. *walkeriana*.
Pteris cretica subsp. *cretica*.
Pteris cretica subsp. *laeta*.
Pteris dixitii (seen in 2006).
Pteris kathmanduensis (Chomrong).
Pteris normalis.
Pteris spinescens (Chomrong).
Pteris subquinata (on dry, slightly calcarous cliffs beneath overhangs, all the green form, none variegated).
Pteris terminalis (Chomrong, also common further up).
Pteris vittata subsp. *emodi*.
Pteris vittata subsp. ?*vermae* (comon on the path-banks just above Birethanti; short, narrow pinnae, short apex, erect fronds).
Pteris vittata subsp. *vittata* (seen in 2006).
Pteris wallichiana - the form or species called *P. yunnanensis* (stipes turn black when mature, with a dense indument of short, stiff, brown hairs).
Pteris dixitii - (New Bridge, seen in 2006).
Vittaria flexuosa.
Vittaria sikkimensis (seen in 2006).
Asplenium laciniatum subsp. *laciniatum* (syn.: *A. varians*; New Bridge, some plants look like subsp. *fraser-jenkinsii*, if they are not hybrids?).
Asplenium laciniatum subsp. *kukkonenii* (upper Chomrong, walls).
Asplenium yoshinagae subsp. *indicum*.
Thelypteris arida.
Thelypteris cana.
Thelypteris dentata.
Thelypteris ?*hispidula*.
Thelypteris erubescens.
Thelypteris esquirolii (creeping rhizome; seen in 2006).
Thelypteris nudata.
Thelypteris ornata.
Thelypteris papilio.
Thelypteris penangiana.
Thelypteris procera.
Thelypteris prolifera.
Thelypteris pyrrorhachis subsp. *distanis*.
Thelypteris torresiana.
Thelypteris tylodes.
Athyrium cuspidatum (Jhinu to New Bridge).

Athyrium drepanopterum.
Athyrium foliolosum (Chomrong).
 [Athyrium x nepalense (*A. drepanopterum* x *A. pectinatum*, seen in 2006).]
Athyrium pectinatum.
Deparia boryana.
Deparia petersenii subsp. *petersenii*.
Diplazium esculentum.
Diplazium laxifrons.
Diplazium maximum.
Diplazium sikkimense (Birethanti, seen in 2006)
Diplazium spectabile.
Arachniodes speciosa (syn.: *coniiifolia*).
Cyrtomium caryotideum.
Dryopteris carolihopei.
Dryopteris cochleata.
Dryopteris juxtaposita (also common further up).
Dryopteris sparsa subsp. *sparsa* (seen in 2006).
Dryopteris sparsa subsp. *viridescens*.
Dryopteris woodsiisora (dead fronds hanging down on cliffs).
Hypodematum crenatum subsp. *loyalii*.
Polystichum annapurnicola (rare, New Bridge, seen in 2002).
Polystichum discretum.
Polystichum lentum.
Polystichum obliquum (under rocks).
Polystichum semifertile (uncommon, New Bridge).
Polystichum squarrosus.
Tectaria coadunata.
Tectaria ?*dubia* (having first reported it as *T. dubia*, then rejected it as mistaken for *T. coadunata*, I now feel this must be either *T. dubia*, or at least something distinct; steep river cliffs by steps, below Jhinu towards New Bridge).
Nephrolepis cordifolia.
Oleandra wallichii (Chomrong, and also common further up above Sinuwa).
Bolbitis major.
Araiostegia squamata.
Davallia trichomanoides.
Davallodes membranulosa (hairy axes, growing on large boulders in moss; also further up).
Leucostegia truncata.
Blechnum orientale (Birethanti to Syauli Bazaar).
Woodwardia unigemmata (beautiful pink young fronds hanging down off cliffs and tall path-banks).

2. Sinuwa - Bamboo - Dovan - Himalaya - Deurali - Machapuchare Base Camp and above (Core area).

Huperzia hamiltonii - and ones with narrower leaves, seeming to have some kind of relationship with *H. pulcherrima*.

Huperzia pulcherrima - shortish epiphytic plants, more the *pulcherrima* form than the *subulifolia* form.

Selaginella chrysocaulos.

Selaginella helvetica.

Botrychium lanuginosum.

Arthromeris wallichiana.

Goniophlebium argutum.

Lepisorus clathratus.

Lepisorus loriformis.

Lepisorus mehrae.

?*Lepisorus morrisonensis*.

Lepisorus nudus.

Lepisorus scolopendrium.

Lepisorus thunbergianus (seen in 2006, above Dovan).

Loxogramma involuta.

Pichisermollodes ebenipes.

Pichisermollodes malacodon.

Pichisermollodes nigrovenia.

Pichisermollodes quasidivaricata (seen in 2006).

Pichisermollodes stewartii.

Pichisermollodes subebenipes (seen in 2006).

Polypodiodes amoena.

Selliguea oxyloba.

Tricholepidium normale (see in 2006; Sinuwa).

Micropolyodium sikkimense.

Tomophyllum donianum.

Hymenophyllum exsertum.

Hymenophyllum tenellum.

Trichomanes campanulatum.

Trichomanes latealatum.

Cyathea spinulosa (also cult. at Birethanti).

Dennstaedtia appendiculata.

Adiantum edgeworthii (seen in 2006, Sinuwa).

Adiantum pedatum.

Adiantum venustum (seen in 2006).

Adiantum wattii.

Aleuritopteris albomarginata.

Aleuritopteris grisea.

Aleuritopteris leptolepis.

Coniogramme intermedia.

Coniogramme procera.

Coniogramme pubescens.

Coniogramme serrulata.

Cryptogramma stelleri.

Onychium cryptogrammoides.

Pteris aspericaulis (also common further down near New Bridge and upwards).

Pteris cretica subsp. *cretica*.
Pteris dactylina.
Vittaria linearifolia (Bamboo to Himalaya, seen in 2006).
Vittaria taeniophylla.
Asplenium amoenum.
Asplenium capillipes (forest from Dovan to Himalaya, mossy rock overhangs).
[*Asplenium* x *capillipoides* (*A. capillipes* x *A. khullari*), seen in 2006, above Dovan]
Asplenium ensiforme.
Asplenium khullarii (also further down in upper Chomrong).
Asplenium laciniatum subsp. *tenuicaule* (seen in 2006).
Asplenium tenuifolium.
Thelypteris auriculata (seen in 2006).
Thelypteris levingei.
Thelypteris mollissima.
Thelypteris ornatipes (Bamboo, seen in 2006).
Thelypteris pyrrhorhachis subsp. ?*hirtirhachis*, or ??*laterepens*.
Thelypteris squamaestipes (Bamboo).
Athyrium atkinsonii.
Athyrium attenuatum (characteristic dark scales on stipe and rachis in the young fronds).
Athyrium distans (seen in 2006).
Athyrium sp. near *dubium*.
Athyrium fimbriatum.
Athyrium roseum (cave below Bamboo). Very rare Chinese species, known only from this locality and above Palmajua near Darjeeling (CRFJ).
Athyrium rupicola.
Athyrium schimperi subsp. *biserrulatum*.
Athyrium setiferum.
Cornopteris banajaoensis.
Cornopteris quadripinnatifida.
Cystopteris fragilis agg. (probable subsp. *dickieana*, subsp. *fragilis* and a very small, high altitude one).
Cystopteris montana.
Cystopteris moupinensis.
Deparia allantodioides.
Deparia subsimilis.
Diplazium succulentum (seen in 2006; Bamboo to Dovan; its furthest west known locality).
Gymnocarpium jessoense.
Matteuccia intermedia.
Woodsia andersonii.
Woodsia sp. ?*lanosa* or ?*rosthorniana*.
Ctenitis apiciflora.
Cyrtomium anomophyllum.
? *Dryopteris acutodentata*.
Dryopteris barbigera.

Dryopteris chrysocoma.
Dryopteris conjugata.
 ?*Dryopteris costalisora* (if not *D. panda*).
Dryopteris gamblei.
Dryopteris komarovii.
Dryopteris lepidopoda (Dovan, uncommon, pinkish yellow young fronds).
 ?*Dryopteris nigropaleacea*.
Dryopteris panda (dead fronds seen in 2006)
Dryopteris subimpressa (seen in 2006; Bamboo to Dovan, rare).
Dryopteris sublacera.
Dryopteris wallichiana subsp. *wallichiana*.
Dryopteris wallichiana subsp. *himalaica* (very common and characteristic in dense forest from Sinuwa to Bamboo)
Dryopteris wallichiana subsp. *nepalensis*.
Dryopteris zayuensis (rare, Deurali).
Nothoperanema squamiseta (rare, Bamboo).
Peranema cyatheoides (seen in 2006).
Phanerophlebiopsis hookeriana.
Polystichum centronepalense (dense wide pale scales, segments like *P. piceopaleaceum*, some with somewhat darker basal scales, forest Dovan to Deurali; rocks at Deurali).
Polystichum lachenense.
Polystichum longipaleatum (superb shuttlecocks and hairy young fronds in dense forest, Sinuwa to Dovan).
Polystichum manmeiense (uncommon, Sinuwa to Bamboo).
Polystichum mucronifolium (rare, Sinuwa).
Polystichum neolobatum (Bamboo to Dovan).
Polystichum nepalense (often very large and lowest pinnae becoming a little lobed at their acroscopic bases, slightly towards *P. manmeiense*).
Polystichum piceopaleaceum.
Polystichum prescottianum (rare, Deurali to Machapuchare Base Camp, all pale-scaled, with slightly shortish pinnae).
Polystichum shensiense (rare, Deurali to Machapuchare Base Camp).
Polystichum sinense (common, Dovan to Machapuchare Base Camp, varying in size, superbly densely pale-hairy and with many narrowish white scales densely clothing the stipe, rhachis and costae; pinnules narrow, without much of a basal lobe).
Polystichum stimulans (small cliffs in forest).
Polystichum thomsonii (varying considerably developmentally in size and depth and crowdedness of lobing).
Polystichum yunnanense (well lobed and densely hairy and scaly; Sinuwa).
Elaphoglossum marginatum (seen in 2006).
Araiostegia beddomei (Sinuwa to Dovan, seen in 2006).
Araiostegia pulchra (also common further down).

ITINERARY

29 May 2012: Microvan, Kathmandu - Mugling - Dumre - Damauli - Pokhara
 (Traveller's Guest House, Royal Palace, Baidam, Pokhara; tel.: 9804132002) (with

Jacob F.-J and Sagun Pariyar).

30 May 2012: Taxi, Pokhara - Kande - Lumle - Naya Pul; walking Naya Pul - Birethanti (1050 m.) - Syauli Bazaar (1200 m.) - Kliu (Kliu Guest House).

31 May 2012: Kliu - Siwai - Kyumi (1300 m.) - New Bridge (1500 m.) - Jhinu (1760 m.) (Tibet Guest House).

1 June 2012: Jhinu - Chomrong (2050 m.) - Sinuwa (2350 m.) - Bamboo (2200 m.) (Buddha Guest House).

2 June 2012: Bamboo - Dovan (2500 m.) - Himalaya (2900 m.) - Deurali (3200 m.) (Dream Lodge).

3 June 2012: Deurali - Machapuchare Base Camp (3700 m.) - Deurali (Dream Lodge).

4 June 2012: Deurali - Himalaya - Dovan - Bamboo (Buddha Guest House).

5 June 2012: Bamboo - Sinuwa - Chomrong - Jhinu (Tibet Guest House).

6 June 2012: Jhinu - New Bridge - Kyumi - Siwai, Jeep to Naya Pul; taxi to Pokhara (Traveller's Guest House, Baidam).

7 June 2012: Pokhara - Devi's Fall - Pokhara, microvan to Markichowk, Marsyangdi Dam; Sagun & Jacob to Kathmandu; CRFJ walked to Komale, Deurali and down and then bus to Mugling - Narayanghat road (Selaginella bryopteris), bus to Mugling - Kathmandu (116 Shahid Gangalal Marg, Naya Bazaar).

To view the entire photo album see - www.photobucket.com/albums/r616/chrisopteris

"Pteridotrivia"

What Fern is the State Vegetable of Vermont?

Visit our homepage, www.hardyferns.org to find out.

What is it with those dang dryopteris, anyway?!

Jo Laskowski ~ Seattle WA

For the past couple of years, the Hardy Fern Foundation staff has highlighted a single fern genus for our educational booth at the annual Northwest Flower & Garden Show in Seattle, WA. We started with *Pyrrosia*. We were fortunate to borrow a magnificent collection from one of our board members, Richie Steffen, to use. We whipped up gorgeous arrangements of these evergreen ferns and distilled information about the growing conditions they like best for our handout. Figuring out what were good genus characteristics took no work. The common name for *Pyrrosia* is “felt” fern, and that single word says it all. Whether the fronds are forked, twisted, crested, crinkled, divided, lobed, or any variation thereof, they bear a dense covering of rusty brown, interlocking hairs on their underside. To touch that is to know you’re touching a *Pyrrosia*, although no one thought we were even using ferns that year.

Last year we chose *Polystichum*. The genus cooperated by having unique and easily seen characteristics. Look at the shape of the indusia—they’re peltate, or umbrella-like. The dot you see in the center of the circular indusia is the “shaft” of the umbrella. As well, the lowest pinnae on each frond carry an auricle, or thumb, close to the rachis, a superb identifier. This is still one of the first things I look for when I’m trying to at least get a fern narrowed down to genus level.

By 2013 the last hardy genus of size we had left was *Dryopteris*. There are some notable, amazing, memorable evergreen species, like *Dryopteris sieboldii*, *D. erythrosora*, *D. cycadina*, *D. wallichiana*, and *D. koidzumiana*. But unlike the polystichums that are mostly evergreen, there seems to be an inordinate number of dryopteris that are rudely deciduous. To my eyes, a lot of them look alarmingly alike, and not only when their fronds are recently unfurled, but even when they’re fully mature—they all pop up in similar variations on light green, floating ethereal fronds. I have found, however, that many, many, MANY people have problems identifying deciduous *Dryopteris*, and I take great comfort in knowing that sometimes species confirmation is only achieved with DNA analysis.



Flower and Garden Show planning
Photo courtesy of Jo Laskowski

So what “makes” a *Dryopteris*? For one, dryopteris possess a distinctive indusial shape among hardy ferns, which is kidney-shaped, or reniform. A 10x magnifier is a help here if you’re not sure, because sometimes the two ends of an indusium touch each other,

making it appear there's a circle with a dot in the center of it. Then you'd be misled into thinking *Polystichum*. But my personal fail-safe for deciding whether reniform or peltate revolves around my gut reaction to glimpsing young indusia. For all the world the young indusia remind me of little white maggots. This is an ID technique I do not share with a lot of people.

Dryopteris also flaunt the most amazing scales, best seen when the crown is visible and the new croziers are swelling, then doing their slow, unfurling dance. If we get a sunny late winter/early spring day the scales positively gleam. They glow in the colors of well-used and lovingly polished copper teakettles to the russet iron oxides that crust well-weathered metals. I'd love it if some of these *dryopteris* could send up a single new frond monthly, after the previous one had graciously died back to allow the spotlight to shine on its successor.

The date of the Garden Show floats, but is always in February. This year it was in the latter part of the month, which can buy you a few weeks if you're frantically forcing ferns. This time, though, it was good that some of the ferns were just beginning to push new growth. *Dryopteris celsa* and *D. crassirhizoma* were magical with their scale-covered croziers and stipes.

Besides gorgeous scales, new fronds of many species emerge clothed in protective shades of red, from the plant pigment anthocyanin. As the new cells harden off, chlorophyll takes over, and the frond gradually transforms to its mature green. *Dryopteris koidzumiana* and *D. labordei* were splendidly dressed in new hues-of-russet fronds. Because this is a common behavior in many plant families, I view this more as a tendency rather than a genus characteristic. But it's especially beautiful in this Polypodiales plant order.

With that, it seemed we'd exhausted key ID features. We'd just have to let some other members of this diagnostically difficult, extraordinarily ornamental genus strut their stuff.

Of course we had a potful of *Dryopteris sieboldii*. It's a stand-alone in the department of stopping people in their tracks. The leathery fronds are unexpected. The shape of the frond is prehistoric-looking. If I were a horticulturist, I'd say the leaf is compound and mostly entire, with two to five pairs of opposite to subopposite leaflets, and a terminal leaflet that is much lengthened. If I were a fernwoman, I'd say, and I quote, "...open blades are leathery and ovate...with two to five pairs of broad, linear...pinnae and a lengthy 6 to 12in. (15 – to 30cm.) terminal pinna." (Thank you, editor!) As predicted, most of the comments drawn by that pot ran to "That's a fern??!"

We let *D. dilatata* 'Jimmy Dyce' hang around just because its bluish foliage is uncommon and so gorgeous. *Dryopteris dilatata* 'Cristata' showed off some of the amazing pinnae perambulations that proliferate



Dryopteris sieboldii

Photo courtesy of Arlen Hill

in this genus. It was pretty stunning, too.

Of all the characteristics and tendencies of dryopteris, the one I most enjoy is its inclination to produce branching rhizomes. They can take on some unexpected forms. I think of one old *Dryopteris filix-mas* in our display gardens that I've cut back over the years. When shorn of its old fronds, you see that this masterpiece has launched multiple growing points, each one advancing along the ground or through the air in unhurried fashion. I see Medusa, the mortal Gorgon of Greek mythology, in its exuberant, sinister, whimsical twists and turns. It always makes me smile. (see photo page 49.)

Spore Exchange Update

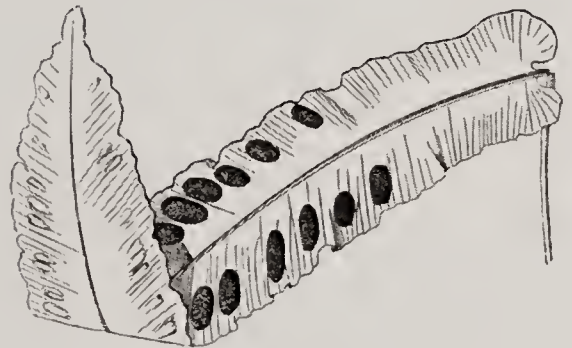
Carolyn Doherty

Puyallup, WA

I would like to improve the process for ordering spore from our Spore Exchange for our members. Spore will continue to cost 50 cents per species. However, I have found that it is impossible to know the exact shipping costs until they are actually mailed. For this reason, I would like members who order spore in the future to either request it by mail to:

Carolyn Doherty, Director of the Spore Exchange
1905 43rd St. SE
Puyallup, WA 98372

Or by email to: ferns spores@hotmail.com with the address where they wish it to be sent.



I will fill the order and enclose the exact cost of the spore, shipping, and a padded mailer if needed (75 cents) in the order. I can also send this information by email. After the member receives their order, they may pay for it by return mail at the above address or by PayPal to the Hardy Fern Foundation if it involves foreign currency. Hopefully, this will improve our system and eliminate shipping cost guessing.

Also, I want to thank donors of spore who take the extra time to package the spore in individual packages. Please try to avoid using tape as spore sticks to it. Individual packaging saves me an enormous amount of time repackaging and labeling the spore when orders come in.

Thanks for your support!

Ferns and the Subordinate Angiosperms of Western China

Kelly Dodson and Sue Milliken ~ Port Townsend, WA

This will be a passionate if pterido-illiterate journey through various plant hunting trips in western China looking at ferns, fern allies and that whole other class of plants whose questionable act of flowering marks them as wallowing in moral botanical turpitude.

Sue Milliken and Kelly Dodson of Far Reaches Farm www.farreaches.com are brown belt plant geeks with a rare plant nursery in Port Townsend sporting nearly 6000 taxa in the collection. They feel pretty confident in their plant knowledge but have never really considered ferns as plants they should know and grow until recently.

It was their 2010 trip to Chongqing, Guizhou and Guangxi that really set the fern hook in them and they realized then that flowering plants are easy to figure out – it's ferns that are hard. Ferns were everywhere in infinite variety and despite Sue's and Kelly's best efforts to gloss over them, they found them mesmerizing. They relinquished their hard-won plant nerd black belt and donned the lesser brown belt of the journeyman plant geek acolyte recognizing that they were not yet worthy as ferns remained simply a blur of indistinguishable pinnae.

With these abundant disclaimers, caveats and codicils, they will show some of the vignettes that stand out in their memory from their recent trips to China. It should be a fun romp through some floristically amazing mountains and they are counting on audience participation with the fern identification!

Best yet, a *Lepisorus macrosphaerus* from Mogecuo, Sichuan will be offered at silent auction with all proceeds going to the Hardy Fern Foundation. This was found growing as a lithophyte on a mossy boulder the size of a chest freezer near the stream feeding Mogecuo Lake. It had erect entire deciduous leaves to six inches with ranked pairs of prominent brown sori and crept about with short surface stolons. It has since proved hardy in our garden growing in a bit of stump in light shade. Be the second person behind Pat Riehl to have this in your garden!



FERN FESTIVAL 2013



Friday, June 7th and Saturday June, 8th

Center for Urban Horticulture, Seattle

Friday Plant Sale from noon - 6:30 pm

Annual Meeting 6:30 pm, Lecture 7:00 pm, by Kelly Dodson and Sue Milliken

Saturday Plant Sale from 9:00 am - 2:00 pm

This sale offers hundreds of species of ferns as well as a large assortment of other unique, shade loving plants!

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welcomed!

*Please send your
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